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GENERAL NOTES.

Members and friends of the Society are invited to aid the Committee on Publication in the work of this department. Communications to this end may be sent to Frank Schlesinger, International Latitude Observatory, Ukiah, California.

Early Knowledge of the Distances of the Stars.—The impression is quite general, but nevertheless erroneous, that astronomy had to wait until the nineteenth century for proper conceptions concerning the immensity of stellar distances. It is true that not until then were instruments perfect enough to enable actual measures of parallax to be made; but as early as the beginning of the eighteenth century the *order* of stellar distances was correctly inferred from methods not unlike and not inferior to those sometimes used at the present time for the same purpose.

In his recent book on "The Stars," Newcomb has the following paragraph (page 142):—

> "Considerations drawn from photometry were also lost sight of, because that art was still undeveloped. Kepler saw that the Sun might well be of the nature of a star; in fact, that the stars were probably suns. Had he and his contemporaries known that the light of the Sun was more than ten thousand million times that of a bright star, they would have seen that if placed at one hundred thousand times its present distance the Sun would still shine as a bright star. If, then, the stars are as bright as the Sun, they must be one hundred thousand times as far away, and their annual parallax would then have been too small for detection with the instruments of the time. Such considerations as this would have removed the whole difficulty."

This method of estimating the distances of stars was originally proposed by James Gregory, who was born eight years after Kepler's death. Huygens (1629-1695) was the first to use it, and he concluded that *Sirius* (presumably one of the nearest of the stars) has a parallax of about 7″; a result which is too great, partly because *Sirius* is intrinsically brighter than the Sun, and partly because of the difficulty of estimating the relative brightness of such greatly different luminaries. This latter difficulty was overcome with great ingenuity by Newton (1642-1727), in whose *Principia* (page 547, Motte's Translation) will be found these words:—

> "The disk of *Saturn*, which is only 17″ or 18″ in diameter, receives but about $\frac{1}{2,100,000,000}$ of the Sun's light; for so much less is that disk than the whole spherical surface of the orb* of *Saturn*. Now, if we suppose

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* That is, a sphere having a radius equal to the distance of *Saturn* from the Sun.

Saturn to reflect about one quarter of this light, the whole light reflected from its illuminated hemisphere will be about $\frac{1}{4{,}200{,}000{,}000}$ of the whole light emitted from the Sun's hemisphere; and, therefore, since light is rarefied in the duplicate ratio of the distance from the luminous body, if the Sun was $10{,}000\sqrt{42}$ times more distant than *Saturn*, it would yet appear as lucid as *Saturn* now does without its ring, that is, something more lucid than a fixed star of the first magnitude. Let us, therefore, suppose that the distance from which the Sun would shine as a fixed star exceeds that of *Saturn* by about 100,000 times, and its apparent diameter will be $0''.002$, and its parallax arising from the annual motion of the Earth $0''.2$; and so great will be the distance, the apparent diameter, and the parallax of the fixed stars of the first magnitude, in bulk and light equal to our Sun."

This estimate, made over two hundred years ago, can hardly be improved upon at the present day. It may be worth while to remark that modern measurements of the albedo of *Saturn* show that this planet reflects at least twice the fraction assumed by Newton.

Had this paragraph of Newton's received more attention from his contemporaries and successors, it might perhaps have led to more hesitation in announcing large parallaxes and measurable diameters for certain stars. Even so late and so eminent an observer as the elder Herschel thought he could detect the true disks of the brighter stars, and actually published some measures of their angular diameters.

The Tychonic System.—The above note suggests a word concerning Tycho Brahe's system, in which the Sun and the Moon were supposed to revolve around the Earth, and the planets around the Sun. It seems to us that this system has been too severely dealt with by writers on Astronomy, who usually refer to it in such terms as "strange," "grotesque," and "unfortunate." It should be borne in mind that Tycho's system, so far as the Sun, Moon, and planets are concerned, is *geometrically* identical with that of Copernicus; that is, the relative motions of any two bodies are the same in either system. The greatest obstacle in the way of the general acceptance of the ideas of Copernicus was the lack of parallax in the stars. Men were just then striving to realize the great distance of the Sun from the Earth. Small wonder that they should hesitate to believe that this distance is a mere point in comparison with the distances to the stars. Tycho's system may therefore be said to fit in better with the observed facts than did that of

COPERNICUS. Especially will this appear to be true when we recall the state of mechanical knowledge at the time. The ideas concerning mechanics were then very vague, even as regards terrestrial phenomena; and the extension of these ideas to the heavens tended rather to disprove than to confirm the motion of the Earth. These considerations must increase our admiration for the genius of COPERNICUS, who was able to see beyond such formidable objections; but at the same time they should make us more lenient toward TYCHO'S system, which from the standpoint of a contemporary had much to commend it.

The Rate of a Clock in Constant Temperature and under Constant Pressure.—At the Case Observatory (Cleveland, Ohio) the experiment has been tried of subjecting an astronomical clock to constant pressure and temperature. The whole clock, together with a barometer and a thermometer, is inclosed in an air-tight compartment from which the air may be partly exhausted. By noting the reading of the barometer, and, if necessary, exhausting the air a little further, it is possible to keep the pressure sensibly constant. The whole arrangement is placed in a constant-temperature room. In this instance, the temperature is automatically kept unvaried by means of thermostats. Professor HOWE has a paper in *Astronomical Journal* No. 524 on the performance of this clock. For a period of three months, in which the clock-error was observed sixteen times (rejecting three nights for reasons given), he finds the daily rates to vary at most only $0^s.022$ from the mean. The daily rates were computed by using the observations only in pairs; that is, each night with the following one. This method of computation is, if anything, unfavorable to the clock, as errors of observation have too large an effect on the rates. This is especially true in the present case because the intervals between observations are sometimes quite short—in one case only twenty-two hours. The writer of this note made a least-square solution to see how well the observed clock-errors would satisfy the assumption of a constant rate. He found that the largest residual (observed *minus* computed clock-corrections) was $0^s.3$. Another solution, using only the last two months, during which period the clock-correction had been determined thirteen times, gave no residual so great as $0^s.10$. Even this quantity, remarkably small though it is, cannot all be ascribed to irregularities of the clock; part of it is due to errors of observation and to errors in the almanac places of the stars, different sets having been used on different nights.

An interesting problem occuring in the method of least-squares is the following: What is the probable error of a given function of x, y, z, etc., when the values of the latter have been found from the same least-square solution? If x, y, z, etc., were independent of each other the answer would be quite simple, but it is clear that they are functions of the same observed quantities, and therefore functions of each other. The problem has been treated in its most general form by HELMERT in his *Ausgleichungsrechnung nach der Methode der kleinsten Quadrate* (page 139). In *Astronomical Journal* No. 523 Mr. HERBERT L. RICE gives a new demonstration of the fundamental formula and points out several places where eminent astronomers have been at fault on this point.

A List of New Variables.—The Committee on Variable Stars appointed by the *Astronomische Gesellschaft* has recently reported a list of twenty-four recently discovered variable stars, whose variability has been confirmed. Most of them were discovered by means of photography. Four of the variables are of the *Algol* type; that is, their light is constant, except for a short time at minimum. The list is rather unusual in the faintness of the stars even at maxima. Only one star reaches a magnitude between six and seven, the next brightest being between the eighth and ninth magnitude at its maximum. One star is never brighter than the eleventh magnitude. This would seem to indicate that most of the variables among the brighter stars have already been detected. It must be borne in mind, however, that in the present state of photometry a variable will probably escape detection unless it nearly doubles its light in going from minimum to maximum, or, in other words, unless it varies nearly three quarters of a magnitude or more. No doubt there are many stars which vary only one or two tenths of a magnitude, and quite possibly, when photometers are sufficiently improved, we shall find that a considerable fraction of all the stars are variable to some extent.

It is understood that the discoverer of a minor planet shall assign to it a feminine name. The only exception to this rule is the case of *Eros,* which, on account of its extraordinary orbit, is justly distinguished from others of the family. To find suitable names, with this restriction, for so many planets has overtaxed the ingenuity of the discoverers, until now no interest whatever attaches to the naming of a minor planet. Dr. DELISLE STEWART has, however, given a particularly apt name, *Occlo,* to the planet discovered by him at Arequipa, Peru, in 1901. *Occlo* was the first queen of the Incas, and, according to native mythology, she was the daughter of the Sun.

It is reported that $50,000 has been raised for an observatory at Amherst. The principal instrument is to be a refractor of eighteen inches aperture. The college already possesses a refractor with a 7¼-inch objective and a reflector of 12-inch aperture, and these will be suitably mounted in the new observatory. There are also to be two transit instruments, clocks, a spectroscope, etc. The observatory will be used for purposes of instruction as well as research.

The trustees of the Benjamin Apthorp Gould fund have granted $300 to Goodsell Observatory for the measurement of *Eros* parallax photographs.

Captain COLBY M. CHESTER, U. S. N., has been appointed Superintendent of the Naval Observatory, to succeed Captain C. H. DAVIS, who has been assigned to sea duty.

Dr. E. S. HOLDEN, formerly of the Lick Observatory, has been appointed Librarian at the West Point Military Academy. Dr. HOLDEN is an alumnus of this institution, of the class of 1870.

HERVÉ FAYE, the eminent French astronomer, died at Paris on July 4th. FAYE was born in 1814, and had been prominent in astronomy for sixty years. In 1843 he discovered the comet which bears his name, and which has a period of only seven and a half years. FAYE was connected with the famous Ecole Polytechnique, as student and professor, throughout nearly the whole of his life. He is most widely known through his theory of sun-spots and through his speculations on the origin of the universe. He was a member of the Academie des Sciences, of the Bureau des Longitudes, and of the International Geodetic Association.

In the death of ADELBERT SAFARIK, which occurred at Prague on July 2d, astronomy has lost another long-tried servant. SAFARIK was born in Hungary in 1829, and he received his training at Prague, Berlin, and Göttingen. His astronomical work consists in observations of the planets and the Moon, and especially of variable stars. In spite of the severe illness of the latter part of his life, he is said to have made during this period no less than twenty thousand observations of variable stars. SAFARIK had a broad knowledge of science in general; for a time he was professor of chemistry at Prague. But astronomy was always his favorite, and never were his observations entirely discontinued.